March 1974 B73-10463

NASA TECH BRIEF

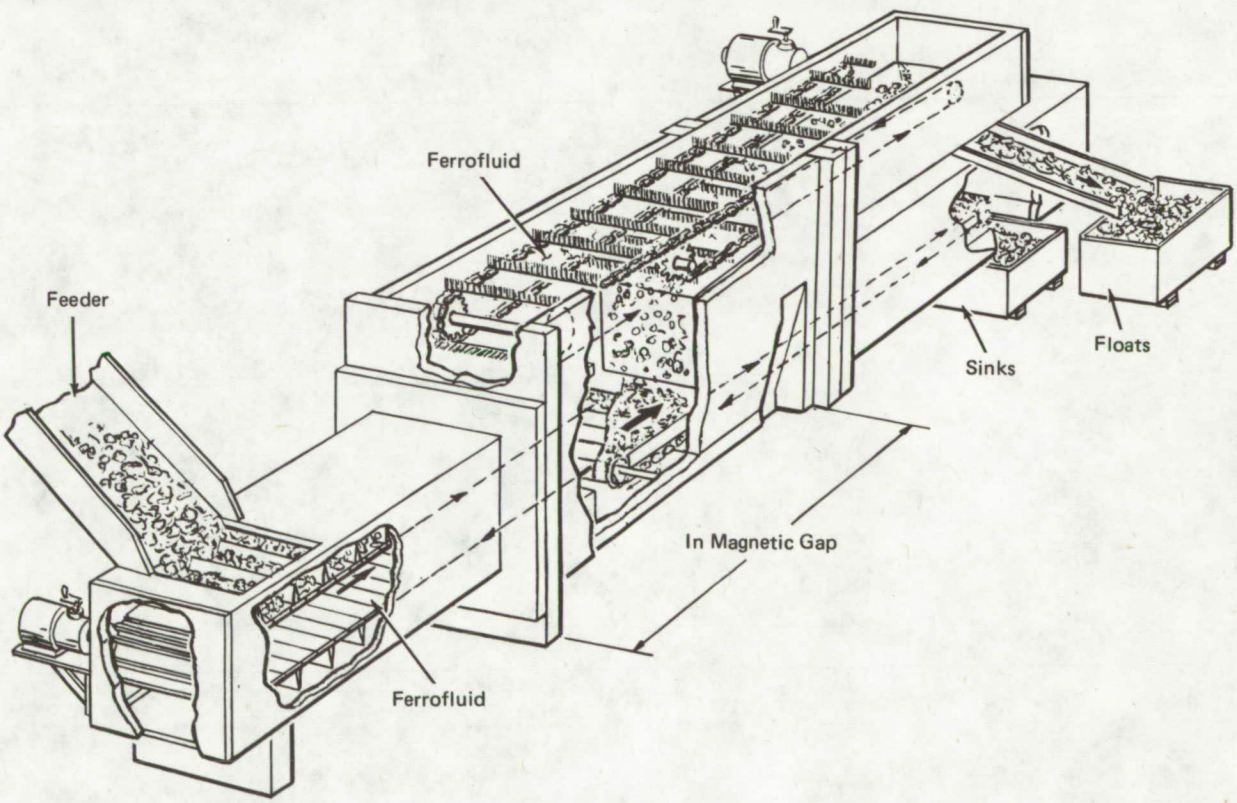
Langley Research Center

Ferrofluid Separator for Nonferrous Scrap Separation

Ferrofluid sink-float separation is an automated process for separating a mixture of nonferrous scrap metals. This method promises to be a profitable process, based upon test data obtained from a prototype separator, and the successful recovery of ferrofluid from the separated scrap.

The ability to selectively control the apparent density of a liquid led to the development of this process, in which nonmagnetic solids of different densities are separated by magnetically controlling the apparent density of a ferrofluid. This process could be applied to many problems where materials of different densities must be separated. The ferrofluid separator appears more versatile, and significantly less expensive to operate, than alternate techniques.

The separator was designed to separate 7.6-cm (3-inch) regranulated, nonferrous automobile scrap into its major components, according to their densities, at a rate of 900 kg/hr (1 ton/hr) on a continuous basis. The separator, shown in the illustration, basically consists of an electromagnet and conveyors.



Ferrofluid Sink-Float Separator

(continued overleaf)

The electromagnet is designed to generate a region of constant apparent density within a pool of ferrofluid held within the magnet poles. The kerosene-base ferrofluid, with 500-gauss saturation magnetization, will have an apparent density of nearly 12 g/cm^3 when the magnet, operated at a maximum power input of 63 kW, generates a field gradient of 250 Oe/cm. This density level is sufficient to float all common industrial metals of interest.

The conveyors are used for introducing the scrap to be separated into the ferrofluid, and removing the separated products. As seen in the illustration, objects less dense than the apparent density of the ferrofluid float to the top of the ferrofluid pool to be recovered by an upper conveyor, while those more dense sink and are removed by a lower conveyor. Since magnetic forces retain the ferrofluid in the gap of the magnet, conveyors can be introduced directly into the pool without sealing problems or fluid leakage. The conveyors of the material handling system have been found capable of moving typical automobile scrap at rates of over 2270 kg/hr (5000 lb/hr).

The behavior of nonmagnetic objects within the separator has been found to be essentially a function of density, and independent of the size or shape of the objects. Typical results show close agreement between the density of the object and the apparent density of the ferrofluid required to float it. These results also demonstrate conclusively that very high separation rates are achievable by ferrofluid sink-float separation and, with optimal adjustment of operating parameters, the separation is virtually error free.

Note:

Requests for further information may be directed to:

Technology Utilization Officer
Langley Research Center
Mail Stop 139-A
Hampton, Virginia 23665
Reference: B73-10463

Patent status:

NASA has decided not to apply for a patent.

Source: Robert Kaiser and Leon Mir of
Avco Corp.
under contract to
Langley Research Center
(LAR-11523)